

IN THE CLAIMS

We claim:

1. A set of masks comprising:
 - a first mask comprising:
 - a first transparent region; and
 - a first opaque region, said first opaque region disposed adjacent to said first transparent region; and
 - a second mask comprising:
 - a second transparent region, said second transparent region having a first phase;
 - a second opaque region, said second opaque region disposed adjacent to said second transparent region;
 - a third transparent region, said third transparent region having a second phase, said third transparent region disposed adjacent to said second opaque region; and
 - a transparent assist feature disposed adjacent to said second opaque region.
2. The set of masks of claim 1 wherein said first phase and said second phase are offset by 180 degrees.
3. The set of masks of claim 1 wherein said first phase is 0 degree and said second phase is 180 degrees.

4. The set of masks of claim 1 wherein said transparent assist feature has said first phase.
5. The set of masks of claim 1 wherein said transparent assist feature has said second phase.
6. The set of masks of claim 1 wherein said second transparent region is disposed adjacent to said third transparent region.
7. The set of masks of claim 1 wherein said first transparent region and said transparent assist feature expose a first part of a layer.
8. The set of masks of claim 1 wherein said second transparent region and said third transparent region expose a second part of a layer.
9. The set of masks of claim 1 wherein said transparent assist feature is surrounded by said second opaque region.
10. The set of masks of claim 1 wherein said transparent assist feature is merged with said second transparent region.
11. The set of masks of claim 1 wherein said transparent assist feature is merged with said third transparent region.

12. The set of masks of claim 1 wherein said assist feature further includes optical proximity correction (OPC).
13. A set of masks comprising:
 - a binary mask comprising a product feature, said product feature including a narrow space; and
 - a phase-shifting mask comprising an assist feature, said assist feature fitting within said narrow space when said phase-shifting mask and said binary mask are aligned.
14. The set of masks of claim 13 wherein said assist feature comprises optical proximity correction (OPC).
15. The set of masks of claim 13 wherein said phase-shifting mask is an alternating aperture phase-shifting mask.
16. A method comprising:
 - providing design data and design rules for a layout;
 - converting said design data into primary features for a set of mask patterns;
 - generating assist features for said primary features;
 - checking whether said design rules are violated;
 - repeating said converting and said generating until said design rules are no longer violated;

verifying whether said mask patterns can be combined to produce said layout;
adjusting said primary features and said assist features until said layout is produced; and
obtaining final mask data for said layout.

17. The method of claim 16 wherein said mask patterns comprise a binary mask pattern and a phase-shifting mask pattern.
18. The method of claim 16 wherein said mask patterns comprise a binary mask pattern and an alternating aperture phase-shifting mask pattern.
19. The method of claim 16 wherein said verifying comprises simulation of lithography, including photoresist apply, exposure, and develop processes, for said primary features and said assist features for said set of mask patterns.
20. The method of claim 19 wherein said verifying further comprises simulation of etch processes for said primary features and said assist features for said set of mask patterns.
21. The method of claim 16 wherein said assist features comprise OPC.

